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Forest Service

United States Department of Agriculture

FS-270

Black Walnut

An American Wood

ORIGINAL

Black walnut is one of America's most valuable tree species. It has been prized since colonial times for furniture, interior finish, and gunstocks. Its nuts have a distinctive flavor that is relished by many, although today the shells are as valuable as the nuts for use as abrasives. The decay-resistant heartwood is chocolate brown and occasionally has darker, sometimes purplish streaks. The sapwood is almost white. It is straight grained, strong, hard, heavy, stiff, easily worked with tools, and stays in place after seasoning. Because of heavy use and wasteful cutting over the years, choice black walnut trees have become scarce, and the price of logs has skyrocketed. High prices have stimulated planting and culture of walnut seedlings by small nonindustrial landowners.

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Black Walnut
(*Juglans nigra* L.)

George Rink[1]

Distribution

Black walnut is found throughout the central and eastern parts of the United States and in southern Ontario, Canada (fig. 1). Its natural range extends from southern Minnesota eastward through southern Wisconsin, southern Michigan, southern Ontario, southern Pennsylvania, through almost all of New Jersey, and northward into the Hudson Valley of New York and eastward through Long Island. Discontinuous outlying pockets of walnut may also be found through central New York, Vermont, Massachusetts, Rhode Island, and Wisconsin. The walnut range extends southward through northwest South Carolina, northern and southwest Georgia, northwest Florida, Alabama, northwest Louisiana, and east Texas. The western limit of the black walnut range includes the eastern parts of Oklahoma, Kansas, Nebraska, and southeastern South Dakota. Black walnut is seldom found in the lower Mississippi Valley and Delta regions or above 4,000 feet in elevation in the Appalachian Mountains. However, black walnut is commercially significant primarily in the central part of its natural range, in the States of Missouri, Iowa, Illinois, Indiana, Michigan, Ohio, West Virginia, Kentucky, and Tennessee.

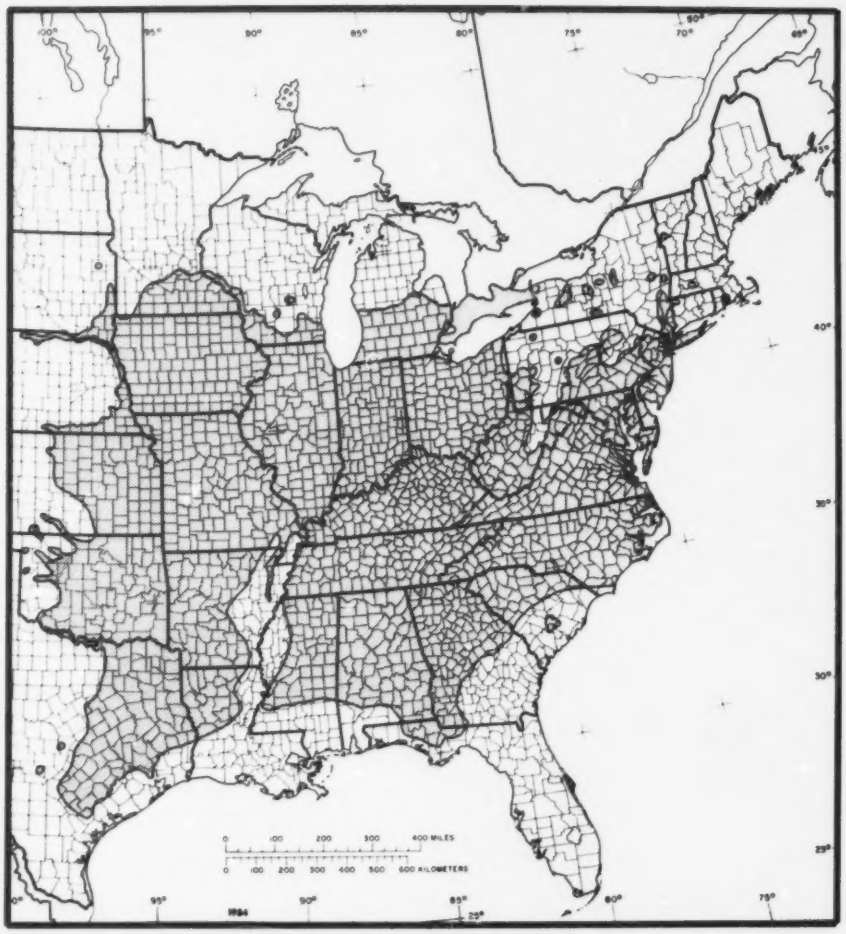

Figure 1—Natural range of black walnut.

Black walnut typically grows as scattered individual trees or in small groups in mixture with a wide variety of other hardwoods. Pure stands of walnut are rare, small groves at the edge of hardwood forests. In the central and northern part of its range, black walnut frequently appears with yellow-poplar, white ash, black cherry, basswood, beech, sugar maple, red oak, and hickories. On the limestone soils in Kentucky, Tennessee, and western Missouri, black walnut is often found growing with redcedar and honeylocust. Other common associates in the southern, central, and western parts of its range include elm, hackberry, green ash, and boxelder.

Description and Growth

Mature black walnut trees on good sites may grow 100 to 120 feet in height and 30 to 40 inches in diameter at breast height (4.5 feet). A few exceptional black walnut trees have been measured that were 130 to 150 feet in height and 72 to 100 inches in diameter. Stems of forest-grown trees are generally straight and limbless, whereas open-grown trees are frequently forked and limby.

Black walnut leaves are compound, 12 to 24 inches long, and composed of 15 to 23 pointed, serrated leaflets each approximately 3 to 3.5 inches long (fig. 2). Black walnut normally begins flowering about mid-April in the southern part of its geographic range and mid-June in the northern part of the range. The male flowers develop in catkins 2 to 4 inches long on 1-year-old twigs. One or two small green female flowers develop in the terminals of new twig growth. Usually flowers of both

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Figure 2—Bark, leaves, and flowers of black walnut.

sexes may be found on the same tree. The fruit, 1.5 to 2.5 inches in diameter, matures in early autumn and has a fleshy husk surrounding a hard shell and an oily, edible seed. The bark of mature walnut trees is gray and deeply furrowed.

Roots, leaves, seed husks, and bark of walnut contain juglone, a substance selectively toxic to many plants, including tree species as well as agricultural crops. Examples of plants sensitive to juglone are: white, Scotch, and red pines; paper birch; apple trees; and tomato vines. The effectiveness of juglone as a toxin is dependent on its concentration in the soil; it is presently thought that a buildup period of 12 to 25 years is needed for planted walnut trees to release enough juglone to produce noticeable inhibition to surrounding plant growth, given the proper soil conditions. On a well-drained, deep soil juglone may have no effect.

Black walnut is sensitive to soil conditions. It grows best on deep, well-drained, nearly neutral soils that are moist and fertile. The most favorable sites are in coves, along narrow streams, and on north- and east-facing slopes. This species does especially well on limestone-derived soils. Black walnut seedlings do not grow well or survive very long on wet bottom lands, on sandy dry ridges and slopes, or on soils underlain by shallow bedrock or gravel, which limits deep rooting. Good internal drainage and soil aeration are prerequisites for good growth of this species.

Black walnut is one of the more rapid-growing hardwoods. On good sites young trees may grow 3 to 4 feet in height per year, and in 20 years may attain heights of 40 to 50 feet with diameter of 6 to 10 inches. Because it responds well to management, growth of immature trees can often be more than doubled by weed control, thinning, and other cultural practices.

Young black walnut seedlings are intolerant of shade and are seldom found under dense canopies of trees. The seed is heavy and is dispersed chiefly by squirrels carrying seeds from beneath the trees and burying them at a distance. Regeneration develops primarily from seed that the squirrels fail to recover. Sprout reproduction occurs but cannot be counted on to regenerate a stand of walnut. Successful artificial regeneration normally involves planting seedlings and controlling competing weeds for at least 3 to 4 years (intensive culture). Nuts may also be planted if adequately protected from rodents.

Good seed crops are produced irregularly, perhaps twice in 5 years. Minimum seed-bearing age is 12 years, although some open-grown trees may produce nuts as early as 4 to 6 years.

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Heavy seed crops do not occur until trees are 20 to 30 years old. Millions of pounds of black walnut seed are harvested annually from naturally grown trees for a variety of uses.

Common Names

Black walnut is the name commonly used. Other names used are American walnut or eastern black walnut.

Supply

The total volume of black walnut sawtimber on commercial forest lands in 1977 was approximately 2,205 million board feet (MMBF, International ¼-inch Log Rule) distributed as follows:[2]

Region	Net Volume (Million board feet)
Middle Atlantic	338.6
Lake	45.4
Central	1,262.8
South Atlantic	247.1
East Gulf	12.8
Central Gulf	219.5
West Gulf	79.0
Total	2,205.2

Nine States (six Central States and three bordering States) each have more than 100 MMBF of sawtimber. Missouri, Kentucky, Ohio, and West Virginia alone have almost 1 billion board feet (over 40 percent) of the walnut sawtimber volume in the country. Since 1963, however, the total walnut sawtimber volume on commercial forest land has declined by approximately 19 percent, from 2,709 to 2,205 MMBF.

In addition to the walnut timber on commercial forest land, some walnut grows in open pastures and narrow forested strips along small streams, windbreaks, and fence rows. These areas, although tree covered, are not classed as commercial forest land because of their small size. Therefore, standing timber from these sources is not included in the black walnut timber-volume estimates reported. Studies in Kansas and Kentucky, for example, indicate that volumes on noncommercial land equal roughly one-fourth the walnut inventory volumes on commercial forest lands.

From 1949 to 1958 the average price for walnut logs was $413 per thousand board feet (MBF). Price ranged from $50 to $960 per MBF depending on the market, log quality, and place of sale. Since 1957, the price trend has been steadily upward for the large veneer-quality logs. In 1970, veneer-quality logs averaged $871 per MBF and export logs averaged $1,578 per MBF; by 1980, the average price of prime veneer logs (export quality) was $4,317 per MBF. High prices paid for walnut logs have stimulated planting and culture of walnut seedlings by farmers and other small nonindustrial landowners.

Production

The cut of black walnut lumber increased irregularly from 38.7 MMBF in 1899[3] to a maximum of 87.3 MMBF in 1918 (fig. 3).

In 1932, a year of business depression, the reported cut reached an all-time low of 9.2 MMBF and gradually increased until 1965, reaching approximately 80 MMBF. Lumber production declined after 1965, dropping to 40 MMBF in 1979.

Black walnut is an important source of decorative veneer. The amount of black walnut used for veneer increased from 1.7 MMBF log scale in 1905 to a maximum of 26.9 MMBF in 1929. In 1931, consumption dropped to 8.5 MMBF because of economic depression. Then in 1943 consumption dropped to an all-time low of 3.5 MMBF. Consumption remained below 10 MMBF until 1957, when it began to increase, reaching a high of 20.8

[2] U.S. Department of Agriculture, Forest Service. An Analysis of the Timber Situation in the United States—1952-2030. For. Resour. Rep. 23. Washington, D.C.: U.S. Department of Agriculture; 1982. 528 p.

[3] Black walnut lumber statistics were first available from the Bureau of Census in 1899. Earlier estimates give a maximum production of 125 MMBF in 1875.

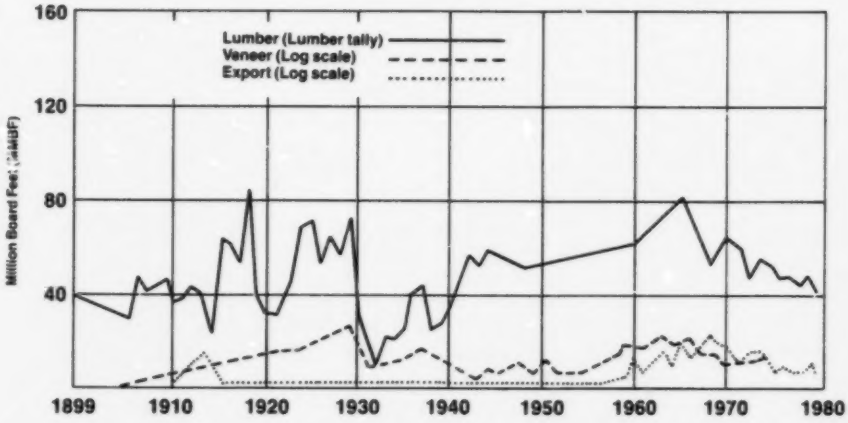

Figure 3—Production of black walnut

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MMBF in 1963. In recent years it has declined; in 1973, the last year for which domestic veneer consumption data were available, production was 12.9 MMBF.

Export of black walnut logs was not important until the late 1950's, rarely exceeding 1 MMBF per year until 1958. After that export gradually increased, reaching a high of 21.9 MMBF in 1968 and subsequently declining to an annual level of 7 to 8 MMBF in the late 1970's. West Germany, Italy, Canada, Japan, Switzerland, The Netherlands, and Great Britain all import large quantities.

Characteristics and Properties

Black walnut is a heavy wood, averaging 38 pounds per cubic foot at 12 percent moisture content with a specific gravity of 0.51 based on green volume and ovendry weight. The wood is hard, strong, stiff, and highly resistant to shock. The heartwood of black walnut ranks with the most durable woods, including cedars, chestnut, and black locust, even under conditions favorable to decay. It can be satisfactorily kiln-dried and holds its shape well after seasoning. Black walnut is normally straight grained, is worked easily with hand tools, and has excellent machining properties. The wood finishes beautifully with a handsome grain pattern (fig. 4). It takes and holds paints and stains exceptionally well. It can be readily polished and satisfactorily glued.

The heartwood ranges in color from light brown to typically dark, chocolate brown, often with a purplish cast and darker streaks. The sapwood is nearly white. Forest-grown trees generally have dark-colored heartwood and a narrow band of sapwood not more than 1 inch wide. In open-grown trees the heartwood is generally lighter in color and the sapwood is about 3 inches wide. It is common practice to darken the sapwood by steaming or staining to match the heartwood. The annual rings of growth are marked by many pores barely visible on the end grain at the beginning of each year's growth and by denser growth at the end of the season. The wood frequently contains alternate light and dark stripes that give figure effects in boards and veneer. Wavy or curly grain near knots, abnormal or irregular growth, crooks, forks, burls (an abnormal growth of wood tissue), and stumpwood also result in a variety of handsome figures. Burls from very old trees are exceptionally valuable, having a bird's eye figure on a glossy dark groundwork ranging from almost jet black to lighter shades of brown.

Principal Uses

Black walnut is used chiefly for furniture and fixtures, and for radio, television and phonograph cabinets, sewing machines, gunstocks, novelties, and interior finish paneling. It is used either in the form of solid wood cut from lumber or in the form of decorative veneer made by gluing sheets of plain or figured veneer to one or both sides of a core. The thickness of domestic walnut face veneer varies between one-fiftieth and one-twenty-fourth of an inch, one-thirty-sixth of an inch being the most common thickness. In Japan, walnut veneer one-hundredth of an inch thick is occasionally produced for specialty products. The core and intermediate plies may be veneer, particle board, fiberboard, or solid wood. Less expensive woods such as basswood and yellow-poplar are generally used for core stock.

Black walnut veneer is generally made by the slicing method and, occasionally, by the rotary-cut method. In the slicing method, a thick slab (flitch) sawed from the log is clamped to a moveable bed that slides up and down in diagonal guides. The flitch is slided into veneer by advancing it against a heavy adjustable knife. In the rotary-cut method, veneer is removed from the log by rotating it against a stationary knife blade. Black walnut is also occasionally sawn into veneer using special saw blades.

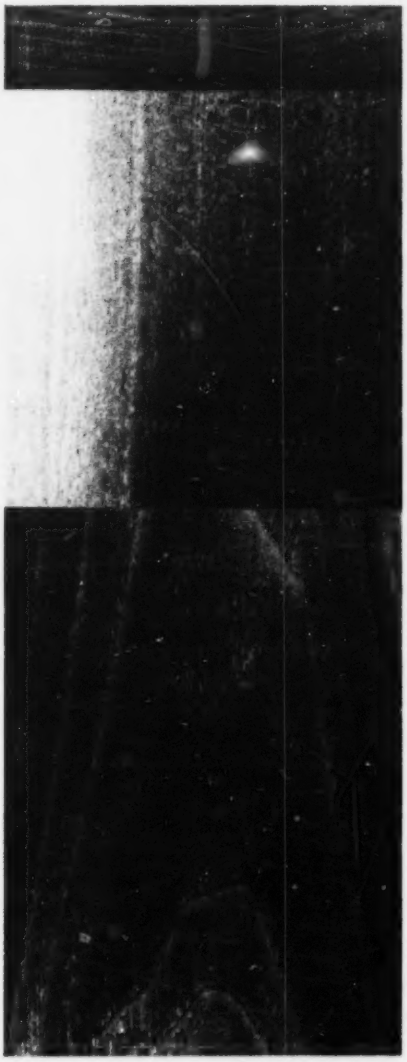

Figure 4—Grain patterns of three sections of black walnut.

Black walnut is used principally for dining room and bedroom furniture. Dining room tables of black walnut stand up especially well under hard

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use. Bookcases, desks, living room tables, and many other pieces are also frequently made of walnut. The wood is in demand for office furniture. It is widely used in all kinds of radio, television, phonograph cabinets, and piano cases. For the highest grade cabinets, plywood panels, faced with figured veneer, are used. For interior finishes in cafes and public buildings where striking effects are desired, walnut is very popular.

The wood is particularly suitable for gunstocks because of its low movement after seasoning, fine machining properties, uniformity of texture, and slight coarseness that makes it easy to grip. It is sufficiently strong and shock resistant without being excessively heavy. Figured black walnut stocks are prized for expensive shotguns and sporting rifles.

The nuts of black walnut are used in candy making and in breads and cakes. However, the shells are thick and the kernels difficult to extract.

The early settlers in America valued the black walnut trees for their wood and nuts, and for the rich brown dye they made from the green hulls of the nuts. The hulls may also have some importance for medicinal purposes. Recent research shows that extracts from the green walnut hull are capable of immobilizing fish, mice, rats, and rabbits. Ground walnut shells are used today as abrasives for metal finishing in the automobile and aviation industries and as a drilling fluid additive in the oil industry.

References

Cavender, Clarence. Utilization and marketing of shells. In: Black Walnut as a Crop: Proceedings of the symposium; 1973 August 14–15; Carbondale, IL. Gen. Tech. Rep. NC–4. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1973: 77–78.

Cooper, Glenn A.; Landt, Eugene F.; Lindmark, Ronald D.; Stewart, Harold A. Changing resource and utilization. In: Black Walnut as a Crop: Proceedings of the symposium; 1973 August 14–15; Carbondale, IL. Gen. Tech. Rep. NC–4. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment station; 1973: 10–16.

Funk, David T. Black walnuts for nuts and timber. In: Jaynes, Richard A. ed. Nut tree culture in North America. Hamden, CT: The Northern Nut Growers Association; 1979: 51–73.

Hoover, William L. 1981 Price report—1st quarter. In: Purdue University Bull. No. 165. West Lafayette, IN: Purdue University, Department of Forestry and Natural Resources; 1981. 16 p.

Lutz, John F. Wood veneer: log selection, cutting and drying. Tech. Bull. 1577. Washington, DC: U.S. Department of Agriculture, 1978. 137 p.

Rietveld, W. J. The significance of allelopathy in black walnut cultural systems. In: Black Walnut for the Future: Proceedings of the Joint Meeting of Walnut Council/Northern Nut Growers Association; 1981 August 11–13; West Lafayette, IN. Gen. Tech. Rep. NC–74. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1982: 73–86.

U.S. Department of Agriculture, Forest Service. Review draft of an analysis of the timber situation in the United States—1952–2030. Washington, DC: U.S. Department of Agriculture; 1980. 789 p.

U.S. Department of Commerce, Bureau of the Census. Lumber production and mill stocks. MA–24T(79)–1. Washington, DC: U.S. Department of Commerce; 1980. 9 p.

Ulrich, Alice H. U.S. timber production, trade, consumptions, and price statistics 1950–1980. Misc. Publ. 1408. Washington, DC: US Department of Agriculture; 1981. 81 p.

Van Sambeek, J.W.; Rink, George. Physiology and silviculture of black walnut for combined timber and nut production. In: Black Walnut for the Future: Proceedings of the Joint Meeting of Walnut Council/Northern Nut Growers Association; 1981 August 11–13; West Lafayette, IN. Gen. Tech. Rep. NC–74. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1982: 47–52.

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